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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/749,986	12/31/2003	Donald S. Gardner	42P18458	9962

8791 7590 04/25/2005

BLAKELY SOKOLOFF TAYLOR & ZAFMAN  
12400 WILSHIRE BOULEVARD  
SEVENTH FLOOR  
LOS ANGELES, CA 90025-1030

EXAMINER
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DUPUIS, DEREK L

ART UNIT	PAPER NUMBER
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2883

DATE MAILED: 04/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/749,986

Applicant(s)

GARDNER ET AL.

Examiner

Derek L. Dupuis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2-11 and 22-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-11 and 22-31 is/are rejected.
- 7) ☒ Claim(s) 10 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments with respect to claims 2-11 and 22-31 have been considered but are moot in view of the new ground(s) of rejection.

### ***Specification***

2. The disclosure is objected to because of the following informalities: the term "lasing" in line 10 of paragraph 14 appears to be an error. The phrase "making the ring being" in lines 13 and 14 of paragraph 15 is improper. These objections were made in the prior office action. The amendment to the specification did not address these objections nor did applicant address these objections in applicant's arguments.

Appropriate correction is required.

3. The amendment to the specification filed by applicant has corrected the other informalities presented by the examiner in the previous office action. Therefore, the objections to these other informalities in the specification have been withdrawn.

### ***Claim Objections***

4. Claim 10 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 11, upon which claim 10 is based, already has the limitation of a pump to excite circulation of light in the microresonator.

5. The amendments to claims 7 and 24 have corrected the informalities presented by the examiner in the previous office action. The objection to claims 7 and 24 have been withdrawn.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 2-11 and 22-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Armani et al (US 2004/0179573 A1)* and further in view of *Chan et al (US 6,236,060 B1)*.

8. Regarding claims 2, 7, 10, 11, 23, 24, and 31, Armani et al teach an apparatus shown in figures 1, 4, 6, and 7. The apparatus includes a silicon substrate (120) (see paragraph 12). A microresonator (110) with an annular structure is disposed on the substrate (120) as shown in figure 1. The microresonator (110) is used to recirculate light at a desired wavelength (see paragraph 4). A waveguide (400) is disposed on the silicon substrate above the microresonator and light is coupled between the waveguide and the microresonator as shown in figures 4A and 4B (see paragraph 47). Armani et al also teach the use of an optical pump to excite circulation of light in the microresonator (see paragraph 50).

9. Armani et al do not explicitly teach that the microresonator comprises silicon dioxide with silicon or silicon germanium nanocrystals. Armani et al also do not teach that a pump tunnels current through the silicon dioxide to form electron-hole pairs in the nanocrystals. Chan et al teaches a light emitting device comprising electrically conductive materials. Chan et al teaches that it is well known to inject silicon nanocrystals or silicon-germanium nanocrystals into a layer of silicon dioxide (see column 3, line 59 to column 4, line 16 of Chan et al). Chan et al

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teach that it is also well known in the art to tunnel current from a source to create electron-hole pairs in nanocrystals (see column 2, lines 43-55).

10. Regarding claims 3-6 and 25-28, Armani et al teach an apparatus as discussed above in reference to claims 11 and 24, respectively. Armani et al teach that the annular structure can be a ring or a disk (see paragraph 26). Armani et al teach that the optical energy within the microresonator can be resonant in a whispering gallery mode (WGM) (see paragraph 12). By definition, a microresonator where the energy is resonant in a WGM is inherently has a circumference that is an integer multiple of the wavelength of the optical signal. The length from the center of the disk to the center of the waveguide forming the disk is, by definition, the radius of the disk. Therefore, radius of the disk is proportional (by  $2\pi$ ) to the circumference which is an integer multiple of the wavelength of the optical signals being resonated in the microresonator. By definition, a disc structured microresonator where the energy is resonant in a WGM inherently has a perimeter that is an integer multiple of the wavelength of the optical signal.

11. Regarding claims 8, 9, 29, and 30, Armani et al teach an apparatus as discussed above in reference to claims 11 and 24, respectively. Armani et al teach that the microresonator comprises a rare earth, specifically, erbium or ytterbium (see paragraph 14).

12. Regarding claim 22, Armani et al teach an apparatus as discussed above in reference to claim 24. Armani et al teach that the distance between the waveguide and the microresonator is "in the order of hundreds of nanometers". This range includes the claimed range of being less than or equal to 250 nm. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d

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257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP 2144.05.

13. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the micro-resonator of Armani et al by injecting silicon or silicon-germanium nanocrystals into a layer of silicon-dioxide and tunneling current through the layer to form electron-hole pairs in the nanocrystals as taught by Chan et al. Motivation to do this would be to result in a "high efficiency electroluminescent structure" (see column 2, lines 50-55 of Chan et al). Furthermore, additional motivation would be that it is common practice in the art to channel current through an oxide layer to form electron-hole pairs to excite energy.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Derek L. Dupuis whose telephone number is (571) 272-3101. The examiner can normally be reached on Monday - Friday 8:30am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on (571) 272-2415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PUD



Frank G. Font  
Supervisory Patent Examiner  
Technology Center 2800